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Australites from Mount Remarkable Station and adjoining parts of Yerilla Station, Western Australia

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Abstract

Collections of australites totalling 926 specimens found on Mount Remarkable and Yerilla Stations in the semi-arid interior of Western Australia have been examined. The more representative units within those collections totalling 476 australites were used for studies of morphology, specific gravity and mean weights. Most of the australites are badly abraded, weathered or broken, only 53% being morphologically classifiable. The frequency diagram of specific gravity has a single mode in the 2.45-2.46 interval and no values above 2.47, suggesting that the australites belong to the 'normal australite' chemical type. The mean weight of whole australites is 4.74 g and of all specimens 2.73 grams.

Introduction

The homestead of Mount Remarkable Station is 167 km north-north-east of Kalgoorlie at 29°19'S, 121°59'E: Yerilla Station adjoins on the west and south sides (Figure 1). These stations are within the semi-arid interior of Western Australia, a region of low relief with internal drainage to salt lakes which rapidly evaporate to dryness. Most larger lakes are elongate and occupy the modified remnants of old river valleys dating from a time of wetter climate. The larger lakes tend to occur in chains and after rare heavy rains they overflow, link up, and re-create parts of the old drainage system.

Australites are generally found on the surface of the ground or partially embedded in soil or other surficial materials. Solifluction processes and rain-wash move australites towards the lakes. They are therefore found especially on the low-lying approaches to the lakes, in the beds of ephemeral rain-wash streams, on the alluvial fans of such streams and elsewhere along the margins of the lakes.

Australite flakes and flaked 'cores' (the remnant pieces from which flakes have been removed) are found occasionally with other rock artifacts at former Aboriginal campsites. They thus constitute a special case of both the sites of occurrence and the nature of the australite specimens (Cleverly and Cleverly 1985).

In 1972 or 1973, a party of men collected about 2000 australites along the western boundary of Mount Remarkable Station for commercial purposes. Examination of the australites was not permitted but Mr K. Jenkins purchased from searchers 46 specimens which were unacceptable to the organiser of the

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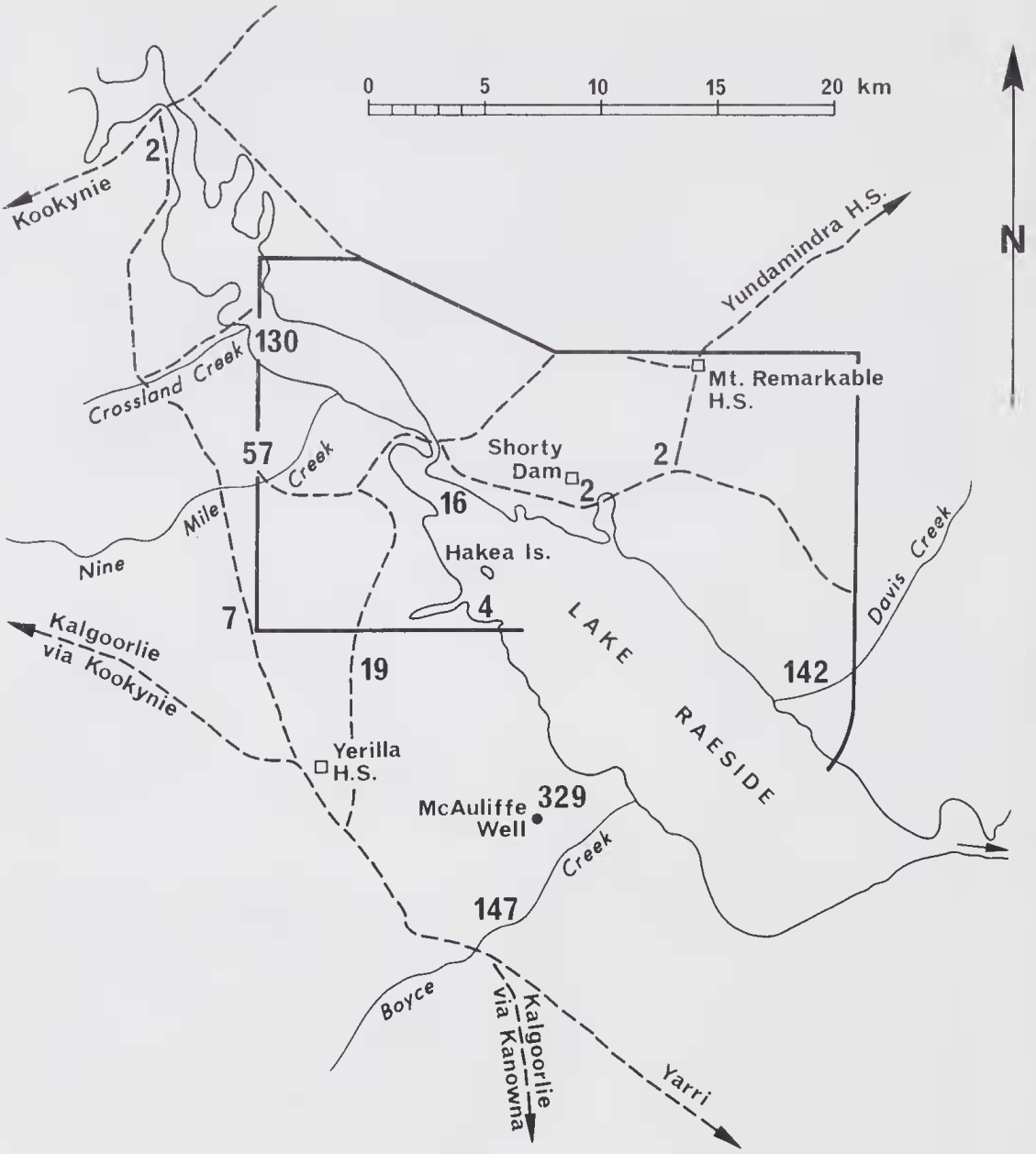

Figure 1 Map of Mount Remarkable Station (firm line boundary) and adjoining parts of Yerilla Station showing sites of find and numbers of australites other than single specimens in the Tillotson and WA School of Mines collections.

search because of small size or frailty. They include 19 small flanged forms or their derivatives, 17 small bowls and tray forms and 3 specimens with the features accepted by Chapman (1964: 857) as showing that they overturned and re-stabilised during ablation flight. The remnant thus shows unusually interest-

ing morphology but is a highly biased sample. The commercial search drew attention to the area and Western Australian School of Mines parties made several visits to Mount Remarkable Station, collecting principally along the western boundary and at the south-east corner (Figure 1). The Mount Remarkable specimens examined were:-

WA School of Mines collection	359
Purchased specimens of K. Jenkins, W. boundary	46
Private collection of N. Moyland (in part), unlocated	15

The specimens from Yerilla Station examined were:-

Tillotson private collections, Boyce Creek	143
WA School of Mines, Boyce Creek and elsewhere on Yerilla Station	34
Tillotson collections, McAuliffe Well	119
WA School of Mines, McAuliffe Well	210

The 187 WA School of Mines specimens from the north-west boundary and 142 from the south-east corner of Mount Remarkable Station are the products of careful collecting in limited areas. This is true also for the total of 147 specimens (Tillotson collections and School of Mines) from Boyce Creek. These three items therefore have the best chance of constituting representative samples. The other major items listed above are from McAuliffe Well. Nearly 95% of these items are flakes or flaked cores which were found in circumstances strongly suggesting that they are artifacts. They are completely uncharacteristic of australite occurrences generally and constitute one of the only two known examples of the abundant occurrence of australite flakes in the Eastern Goldfields region (Cleverly and Cleverly 1985). Thus of the more than 900 specimens examined, only 476 were accepted as satisfactory samples for studies of morphology, specific gravity and average weights.

Specific Gravity

The acceptable samples from Mount Remarkable Station are from two localities 26 km apart: Boyce Creek on Yerilla Station is more than 10 km further distant (Figure 1). If these samples are parts of a single population, they can be treated as a single unit. This possibility was investigated through specific gravity which is closely related to chemical type (Chapman 1971).

The mean specific gravity for a sample of 25 specimens from the western boundary of Mount Remarkable Station is 2.449 with standard deviation 0.011, and for a sample of 25 from the south-east corner, 2.449 ± 0.010. The weighted mean is 2.451 for each sample. Frequency diagrams of specific gravity for each sample show single pronounced modes in the 2.45 – 2.46 interval. These australites were therefore accepted as parts of the same population. A frequency

diagram of specific gravity for the 50 australites from the combined Mount Remarkable localities is shown in Figure 2 with the diagram for 265 specimens from Boyce Creek, Yerilla Station (Chapman 1971, Figure 5). Chapman's sample was taken from the Tillotson collections in which specimens from McAuliffe Well are included under the heading 'Boyce Creek'. The sample therefore contained 45% flakes or flaked cores. Flaking, like other kinds of fragmentation, may affect specific gravity (Cleverly 1988: 42) and is probably a contributory factor to the small differences between the frequency diagrams. The relatively small number of specimens in the Mount Remarkable sample might also be contributory. However, the general form of the Mount Remarkable diagram with a single strong mode in the 2.45 – 2.46 interval and a lack of any values above 2.47 suggests that the australites belong to the same 'normal australite' chemical type as those of Boyce Creek (Chapman 1971). Thus the 476 specimens from Mount Remarkable and Yerilla Stations can be treated as a single unit.

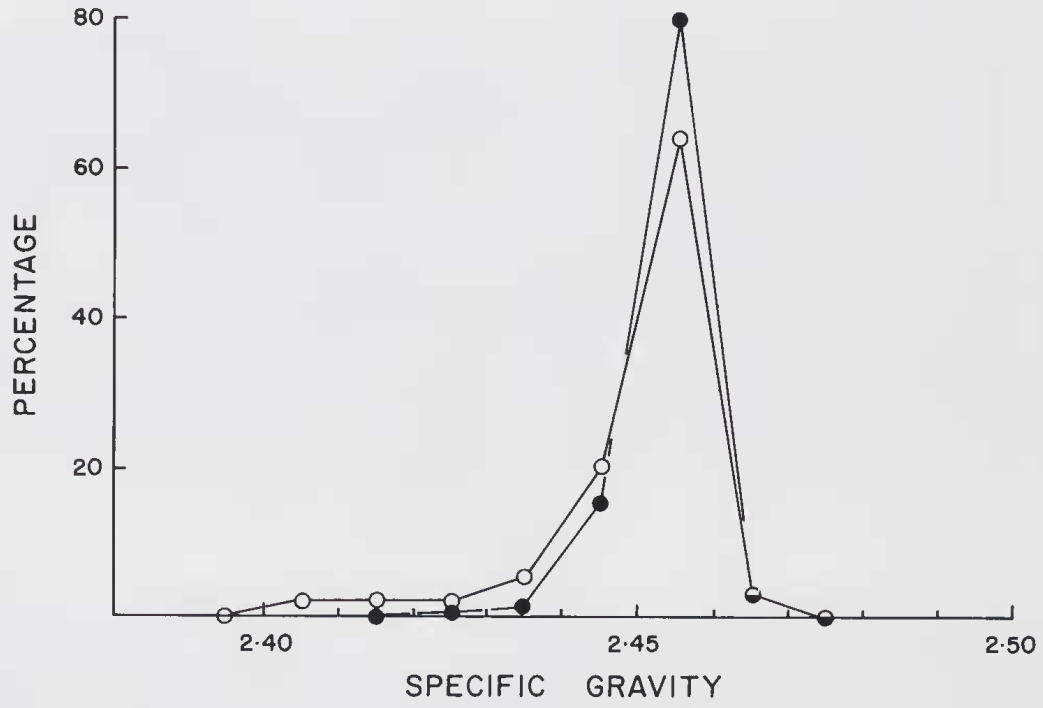

Figure 2 Frequency diagrams of specific gravity for australites. Open circles: diagram of 50 australites from Mount Remarkable Station. Filled circles: diagram of 265 specimens from Boyce Creek inclusive of McAuliffe Well redrawn from Chapman (1971, Figure 5).

Morphology

The morphological classification in Table 1 follows the system of Cleverly (1986) for the 476 australites discussed above. Only 26 of the 48 shape types in the

system are represented. Of those 26 shape types, only 4 are in quantities greater than 5% of the classifiable specimens.

Extracts from Table 1 are used in Table 2 to make a comparison with australites from Hampton Hill Station, *c.* 100 km to the south (Cleverly 1986). The classifiable specimens (items 1 and 2, Table 2) total 53.2% compared with 49.8%

Table 1 Morphological classification and masses of australites from Mount Remarkable and Yerilla Stations according to the system of Cleverly (1986).

Shape type	Number of specimens			Weights of complete specimens (g)		
	Whole	Broken	Total	Lightest	Heaviest	Mean
Button	-	1	1	-	-	-
Round bowl	1	6	7	0.17	-	-
Round indicator I	5	2	7	0.61	4.21	2.04
Lens	50	22	72	0.29	2.99	1.26
Round indicator II	4	-	4	3.89	6.48	5.18
Round core	23	6	29	2.49	20.97	7.30
Broad oval bowl	3	2	5	0.22	0.36	0.27
Broad oval canoe	1	-	1	1.80	-	-
Broad oval lens	8	1	9	0.16	2.60	1.33
Broad oval core	11	1	12	1.98	35.31	8.86
Flanged narrow oval	-	2	2	-	-	-
Narrow oval lens	5	4	9	1.11	2.05	1.65
Narrow oval indicator II	1	-	1	8.03	-	-
Narrow oval core	8	2	10	5.44	20.81	11.05
Boat-indicator 1	1	-	1	1.17	-	-
Boat-lens	3	5	8	1.36	9.18	5.39
Boat-indicator II	2	-	2	2.48	3.87	3.18
Boat-core	5	1	6	5.05	24.74	11.01
Dumbbell-canoe	1	-	1	2.12	-	-
Dumbbell-lens	5	9	14	0.42	6.50	2.62
Dumbbell-indicator II	1	-	1	7.79	-	-
Dumbbell-core	1	3	4	63.60	-	-
Teardrop-lens	5	1	6	0.58	2.05	1.20
Teardrop-core	1	-	1	5.64	-	-
Conical core	33	-	33	1.41	22.43	5.58
Aberrant	5	2	7	2.14	8.74	5.76
	183	70	253		Overall mean:	4.74 g
Unclassifiable, mostly fragments			212			
Flakes and flaked cores			11			
			476			

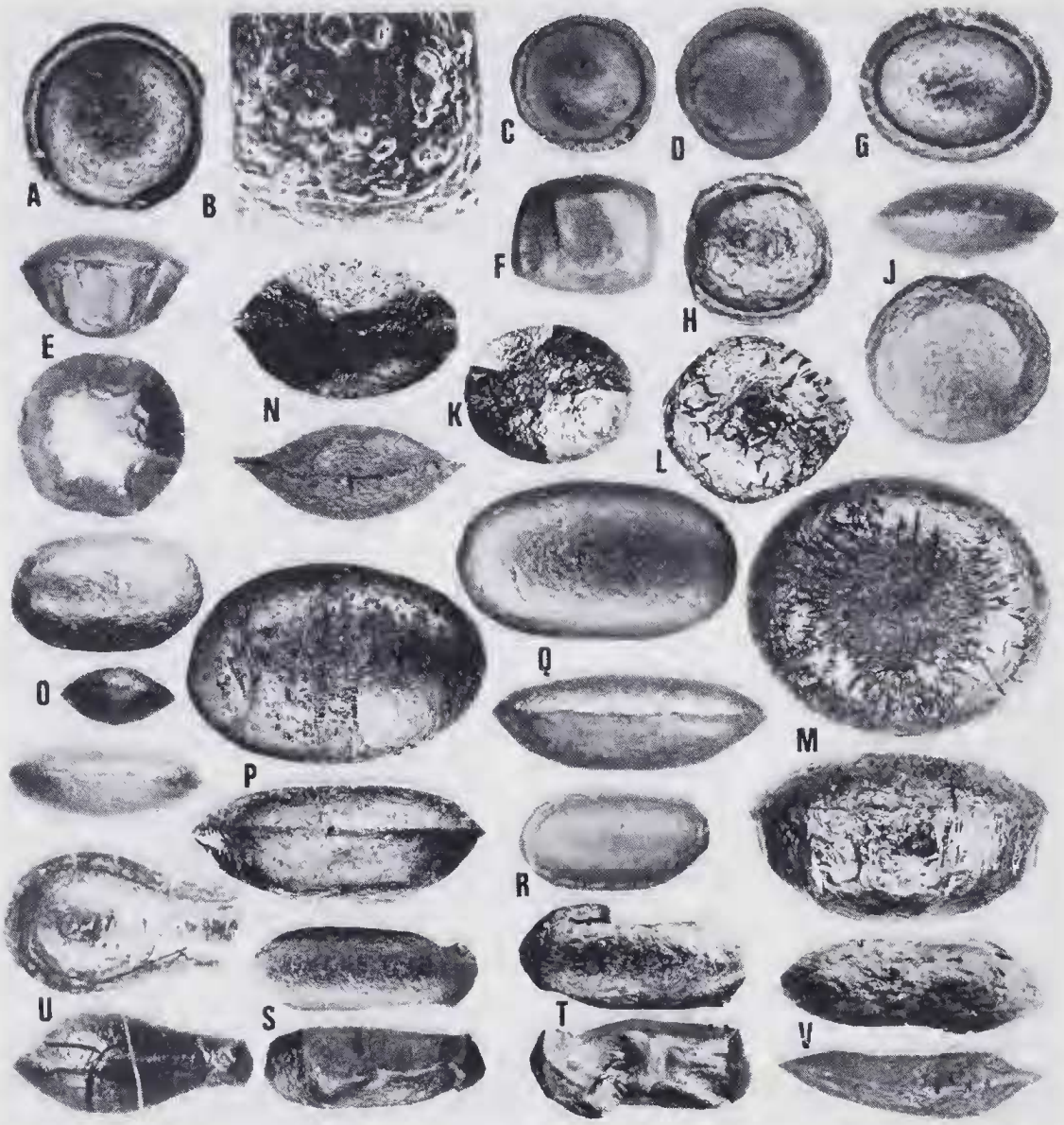

Figure 3 Australites from Mount Remarkable and Yerilla Stations, Western Australia, natural size unless otherwise stated. In elevational views, direction of flight is towards bottom of page. A. Round indicator I, posterior view, x 1.33. B. Part of posterior surface of A showing abundance of 'fingers', x 4. C. Button, core barely emergent, posterior view, x 1.5. For cross section see Cleverly (1979, Figure 4E). D. Round bowl, posterior view, x 1.8. For cross section see Cleverly (1979, Figure 4F). E. Round core, elevational view above, anterior view below. F. 'Small' round core, elevational view, flight orientation uncertain. G. Flanged broad oval, posterior view. H. Broad oval indicator I, posterior view. J. Broad oval lens, elevational view above, anterior view below, x 1.5. K. Broad oval with 'tortoise-shell' ridges

on posterior surface. L. Broad oval core, shape affected by flake losses, posterior view. M. Broad oval core, posterior view above, side elevation below. N. Narrow oval canoe, posterior surface above, side elevation below, x 1.5. O. Narrow oval lens posterior view above, end and side views below, x 1.33. P. Narrow oval core, posterior and side views. Q. Narrow oval core, posterior view above, side view below. R. Narrow oval lens with butt of flange, posterior view. S. Boat indicator II, posterior view above, anterior below showing wedged form of core. T. Boat indicator II with saw-cut on junction of core with stress shell, posterior view above, anterior below. U. About half of a flanged dumbbell, posterior view above, side view below. V. Asymmetrical dumbbell-lens derived from dumbbell-canoe, posterior view above, side view below.

Table 2 Comparison between australites from 1. Mount Remarkable-Yerilla area (this work). 2. Hampton Hill Station (Cleverly 1986). 3. Beltana, SA (Chalmers *et al.* 1976).

	1	2	3
1. Complete forms or essentially so %	38.5	36.5	
2. Incomplete but classifiable %	14.7	13.3	
3. Unclassifiable, mostly fragments %	44.5	49.1	
4. Flakes and flaked cores %	2.3	1.1	
5. Round forms %	59.8	66.0	
6. Broad oval forms %	13.4	9.8	
7. Narrow oval forms %	8.9	8.1	
8. Boat forms %	6.9	4.5	
9. Dumbbell forms %	8.1	8.4	
10. Teardrop forms %	2.9	3.2	
11. Flanged forms, discs and plates, bowls and canoes %	6.9	0.6	
12. Indicators I %	3.3	0.6	
13. Lens forms %	47.9	53.6	
14. Indicators II %	3.3	0.2	
15. Cores including conical %	38.6	45.0	
16. Number of essentially complete australites	183	7993	101
17. Mean weight of above (g)	4.74	3.08	5.0
18. Total number in sample	476	21927	212
19. Mean weight of all specimens (g)	2.73	1.99	3.14

for the sample from Hampton Hill Station, suggesting that the general environment of weathering and erosion has been slightly less severe in the northern locality. A possible explanation for the difference is that the find sites in the Mount Remarkable-Yerilla area, though mostly in the approaches to Lake Raeside and in the beds of entering streams, are much less exposed than the wide Lake Yindarlgooda and its approaches (Cleverly 1986, Figure 1), where abrasion by blown sand is severe.

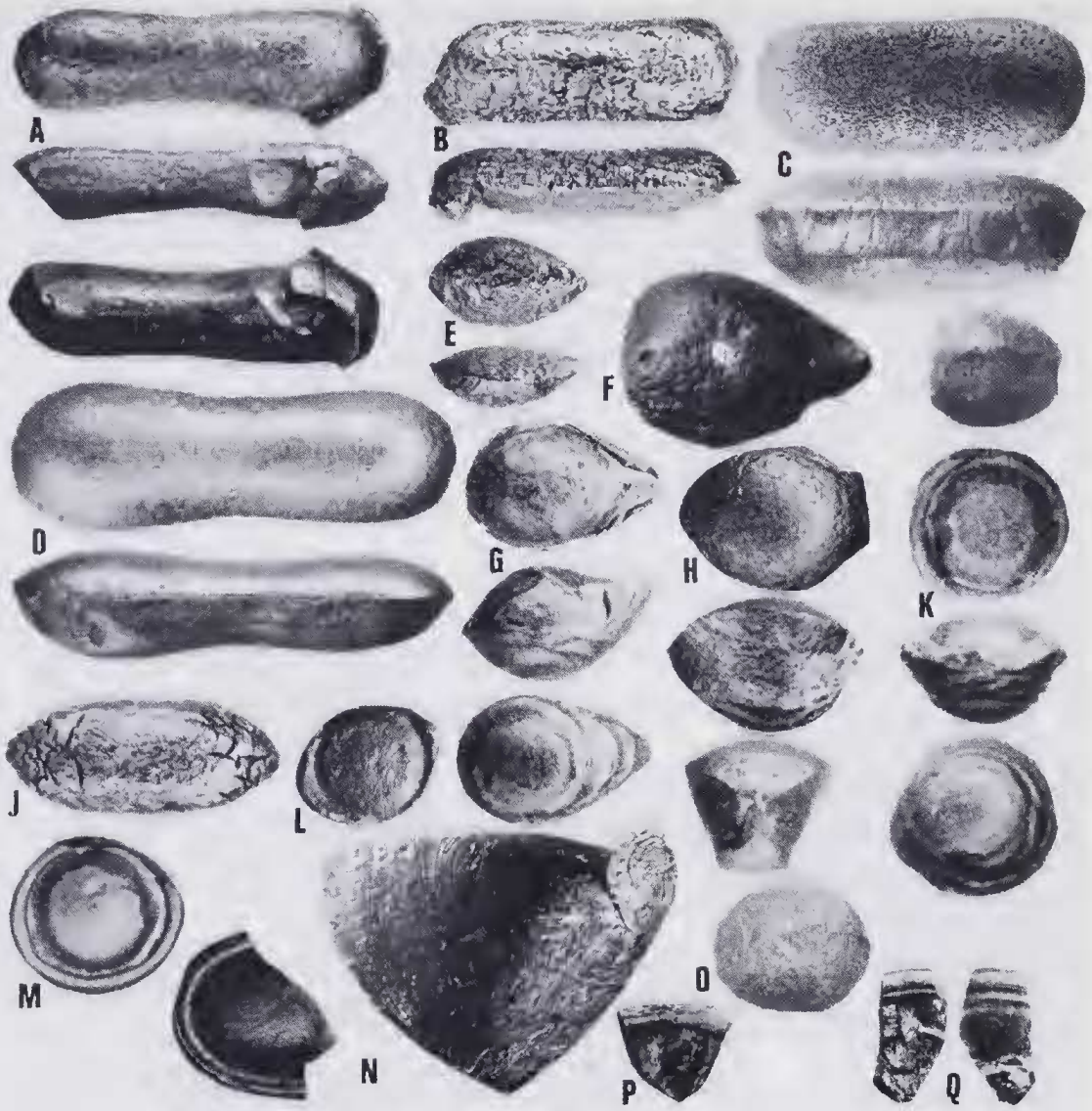

Figure 4 Australites from Mount Remarkable and Yerilla Stations, Western Australia, natural size unless otherwise stated. In elevational views, direction of flight is towards bottom of page. A. Dumbbell-indicator II, posterior view above, elevational and anterior views below. B. Dumbbell-indicator II, posterior view above, elevation below. C. Stout-waisted dumbbell-core, posterior view above showing loss by abrasion at upper left, side and left-hand end elevations below and below right, all x 0.67. D. Asymmetrical dumbbell-core, posterior view above and side elevation below. E. Teardrop-lens, posterior view above, elevation below, x 1.5. F. Teardrop-lens with breached central bubble cavity, posterior view with back lighting, x 2. G. Teardrop-indicator I, posterior view above, elevational and anterior views below. H. Conical core, posterior view above, side and end elevations below. J. Canoe-like aberrant, supposed anterior surface. K. Round indicator 1, posterior view

showing supposed flow ridge, side and anterior views below, x 1.75. L. Round bowl, broken, posterior view with trace of ridge on posterior surface, x 1.5. M. Slightly oval indicator I, posterior view showing ridge on posterior surface, x 1.5. N. Fragment of elongated flanged form on left and naturally etched broken surface of the same at right enlarged x 4, showing schlieren normal to primary (posterior) surface at upper left, dragged along secondary surface at lower right and coiled into flange. O. Australite pebble, shape classification indeterminate. P. Composite fragment of flange plus stress shell, inner (broken) surface. Q. Composite fragment of flange plus stress shell, broken inner surface on left, outer surface with flow ridges on right.

The abundances of the plan view shapes adjusted according to the method of Cleverly (1986: 88) are shown in items 5-10 of Table 2. They do not differ greatly between samples from the two stations, provided that the totals of round and broad oval shapes (73.2% and 75.8%) are used in the comparison. Such a procedure is justified because personal judgment is involved in distinguishing between those two shapes.

The percentages of the elevational view shapes (items 11-15, Table 2) are distinctly different in samples from the two stations. Flanged and fragile forms and indicators still in progress towards lens and core forms total 13.5% in the Mount Remarkable-Yerilla sample compared with only 1.4% for the Hampton Hill sample. These figures confirm that weathering and erosion processes have been somewhat less severe in the more northern localities.

Mean Weights

The mean weights of australites from Mount Remarkable-Yerilla (items 17 and 19, Table 2) are rather high compared with those for the Hampton Hill sample. Higher mean weights have been reported from elsewhere in Australia, but most of them are suspect for one or more of the following reasons:-

(a) The sample is numerically small in conjunction with a high mean weight for all specimens, whether whole or fragment, suggesting casual or incomplete collecting.

(b) The few specimens of very high mean weight (~10-20 g) were sparsely distributed over a very large area e.g. the Murray-Darling confluence region (Baker 1973) or northern Western Australia (Cleverly 1976). Such australites might have been transported there by human agency.

(c) The sample is too good to be believable as representative, e.g. the collection from Morgan, SA (Baker 1968), in which all 148 specimens are nameable and only 3 incomplete. A bias towards retention of the most perfect specimens for the private collection is suspected because Mawson (1958) had reported 45.1% un-nameable fragments in a collection of 1475 specimens from the same region and a much smaller average weight. Australites from

Beltana, SA (Table 2) are perhaps a genuine example of higher mean weights than for australites from the Mount Remarkable-Yerilla area, though the numbers of specimens are small and paragraph (a) above might therefore apply. The mean weights for the examined material have been accepted in the absence of any conflicting evidence.

Notes on some individual specimens

Details of 13 small specimens, mostly bowls in the weight range 0.10-0.45 g, have been given by Cleverly (1979).

Four previously described aberrant specimens are from various points on Mount Remarkable and Yerilla Stations (Cleverly 1982a). Three further specimens in the collection of Mr K. Jenkins have ridges which are thought to be flow ridges on both major surfaces (Figure 4K-M) and a flange appropriate to one of the sets of ridges. These features suggest that the australites overturned completely and re-stabilised during ablation flight, the flange being that developed during the second orientation. The three specimens closely resemble a rather better preserved one from the Kalgoorlie area which was thus interpreted by Chapman (1964: 857 and Figure 18). The three views in Chapman's figure are closely comparable with the three views shown in Figure 4K of this paper.

Four hollow australites from Mount Remarkable and Yerilla Stations have been described by Cleverly (1982b). Several other hollow forms have been collected including a teardrop lens from Boyce Creek with breached cavity *c.* 5 mm diameter (if spherical) located on the line of flight (Figure 4F).

Australite flakes and flaked cores found in association with rock flakes at water sources, suggesting that they are artifacts, have been noted on Mount Remarkable Station at a claypan adjoining Shorty Dam and on a low rise overlooking Davis Creek (Figure 1). Similar material has been recovered on Yerilla Station at Prospector Pool, Four Mile Pool, Top Pool and McAuliffe Well: location and recovery details have been given by Cleverly and Cleverly (1985).

Other notable specimens include a rare example of an australite (a boat-core) firmly cemented into ferruginous grit in the bed of Davis Creek (Cleverly and Kirsch 1984). A stout-waisted dumbbell-core weighing 63.6 g (Figure 4C) was found on its side and firmly wedged into slaty outcrop in the bed of Crossland Creek near its discharge into Lake Raeside. The shape has been visibly affected by abrasion losses from the upper side by the sand swept over it though the mean annual rainfall is only about 200 mm and it is unlikely that the creek would flow more than once or twice a year, and then very briefly. Half a flanged dumbbell (Figure 3U) and a partially flanged teardrop (Figure 4G) are also noteworthy.

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